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ABSTRACT

This study summarizes data collection activities associated with the first two years of a large scale project involving teachers of science and mathematics with computers. The innovation being implemented in the project is that of using computer based strategies directly in the teaching of science and mathematics in the classroom and laboratory. During the summers of 1986 and 1987, two separate populations of inservice science and mathematics teachers participated in workshops designed to assist them in the use of computer based activity teaching for their classrooms. Each group followed a project orientation rather than traditional strategies in learning how to employ computers in the teaching of science or mathematics content. Each group completed the SoCQ instrument developed from the Concerns Based Adoption Model. Responses were collected during pre-, post-, and post-post-sessions. For the first year's group significant reductions in concern were observed using t-tests for three of the "Stages of Concern," with "Refocusing" the only stage to emerge as significantly more of a concern at the conclusion of the workshop. Post-post responses differed very little and nonsignificantly from the post responses. (Author/TW)

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Mainstreaming Computers in Science and Mathematics Education: A Two Year Study

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Mainstreaming Computers in Science and Mathematics Education: A Two Year Study

Abstract

This study summarizes data collection activities associated with the first two years of a large scale NSF-sponsored project involving teachers of science and mathematics with computers. The innovation being implemented in the project is that of using computer based strategies directly in the teaching of science and mathematics in the classroom and laboratory. During summers of 1986 and 1987 two separate populations of inservice science and mathematics teachers participated in workshops designed to assist them in the use of computer based activity teaching for their classrooms. Each group followed a project orientation rather than traditional strategies in learning how to employ computers in the teaching of science or mathematics content. The 1986 group numbered 54 Ss while there were 132 Ss involved in the 1987 study. Each group completed the SoCQ instrument developed from the Concerns Based Adoption Model (CBAM). Responses were collected during pre-, post- and post-post sessions. Pre- and post-responses were collected during the three or two weeks of each summer workshop. The post-post responses were collected six months later. For the first year's group significant reductions in concern were observed using

t-tests for three of the Stages of Concern with only Refocusing emerging as the only stage to emerge as significantly more of a concern at the conclusion of the workshop. Post-post responses differed very little and nonsignificantly from the post responses. During the second year nearly the same trends were observed. The project will continue to collect post-post data for year two as part of a four year study.

Mainstreaming Computers in Science and Mathematics Education: A Two Year Study

Introduction:

In the past, evaluation of the effectiveness of workshops conducted to assist inservice teachers was usually conducted by compassing grades on paper and pencil tests given prior to and at the conclusion of the workshop sessions. In this program, the key emphasis was to determine if the concerns of the participants migrated away from information aquisition at the beginning to concerns more directly related to implementation in the classroom. The innovation providing the focus for the workshops was the use of the computer directly in the regular classroom or laboratory as part of normal classroom or laboratory activities. Teachers who participated in the program had the opportunity to develop their expertise to use computers and other technological tools for instruction in many of the same ways they are used in research and industry. The mathematics teachers primary uses of computers were for modeling and simulating whereas the science teachers primary use of computers was for interfacing with laboratory equipment.

The instructional strategy used was a structured developmental project orientation. Rather than using traditional lecture and laboratory methods as major strategies, participants were divided into teams to work in small groups with faculty as they used software and hardware to development ways for implementation into the classroom/laboratory. In mathematics, this took the form of developing lesson structures into which to implement generic software. In the sciences it meant structuring laboratory experiments and demonstrations which featured computer-instrument interfacing. Science participants were not required to write in computer languages, but rather applied data manipulating

software to interpret data collected with workshop developed sensor systems. The interfacing board used was commercially produced.

Purpose:

The purpose of this study was to create the background data necessary to follow a long term and large scale implementation project through its four years of operation. In this opening stage, the major objective was to study the implications of using the Concerns Based Adoption Model (CBAM) for this purpose. (Hord, Rutherford, Huling-Austin, and Hall, 1987.)

Theoretical Basis for the Study:

The CBAM model as developed by Hall and his colleagues presents the implementation of an innovation into a school as a process involving seven states. The model predicts that persons move from concerns about the structure and qualities of the innovation through concerns about managing the innovation in the classroom through making the innovation even more effective than originally presented. This is a useful, predictive model for a series of development and implementational workshops as it projects exactly the route typically desired by workshop directors. This phase of the research was limited to the application of the CBAM model to the first two years of participants of a projected four year project.

Procedures:

Each of two years of the study, participants took the CBAM instrument called the SoCQ. The instrument was used as designed except that the response scale was shortened from a seven point scale to a five point scale thus making answer sheets machine readable. The SoCQ was administered three times. The administrations were: at the opening of the summer workshop, at the conclusion

of the summer workshop and six months after the summer workshop. Workshops were held in the summer of 1986 and 1987. Only the first two administrations of the 1987 group have been conducted. Raw scores were calculated for each of the States of Concern by summing appropriate items. The result is a set of scores for Awareness, Information, Personal, Management, Consequence, Collaboration and Refocusing. Each concerns area was compared with the previous administration using a t-test. The critical level was selected at or beyond p = .01. Individual SoCQ items were also compared using Chi-square analyses to determine if specific items could be interpreted apart from the general CBAM model.

The entire group of participants present at testing sessions formed the population of this study. Under these circumstances the intact groups' results can only be interpreted as possible trends. The advantage in this project is that four years of independent samples will eventually be available for study.

Data in this study were provided by 132 Ss for the 1987 group and 54 Ss for the 1986 group. The workshops were not of equal duration. In 1987, the participants worked for three weeks including evenings while the 1986 workshop was two weeks in duration. There was much more time devoted to exploratory activities with hardware and software during 1986 than in 1987. The second year also featured the return of twelve specially selected participants from the first year's group to act as assistants to the project faculty especially for work on in class use of the innovtions.

Results:

Each of the two years will be presented separately. During 1986, there were four significant pre-post differences and no post to post-post differences. Significant differences showing a reduction of concern from pre- to post-test were demonstrated for Awareness, Information, and Personal. There was

significantly more concern expressed for Refocusing, however, on the post-test. During 1987, significant differences were demonstrated for Awareness, Information, Personal, and Consequence. Again, there was a significant increase in Refocusing dimension as compared from pre- to post-tests.

Conclusions:

The results of the analyses of CBAM data so far compare well with the theoretical model. In the magnitude of the scores, however, both groups studied maintained a concerns level above 60%, whereas on all scales, studies of schools involved in specific innovations usually show means lower than that level. Much descriptive and analytical work remains to be done before the utility of the CBAM model will be understood as it applies to groups of a regional or national scope who volunteer to participate in innovation. Internal evaluation instruments indicated that both year samples were satisfied or very satisfied with style and type of instruction provided them. A comparison of the two years of CBAM data demonstrates nearly the same pattern of change away from awareness and information concerns to management and refocusing concerns. Work needs to be conducted on why concerns for awareness and information do not fully disappear with time as the model predicts. It is possible that with regional and national volunteer groups that their concern for such aspects of innovation should be expected to stay high.

Reference:

Hord, S., Rutherford, W., Huling-Austin, L., & Hall, G. (1987). Taking charge of change. Alexandria, VA: Association for Supervision and Curriculum Development.